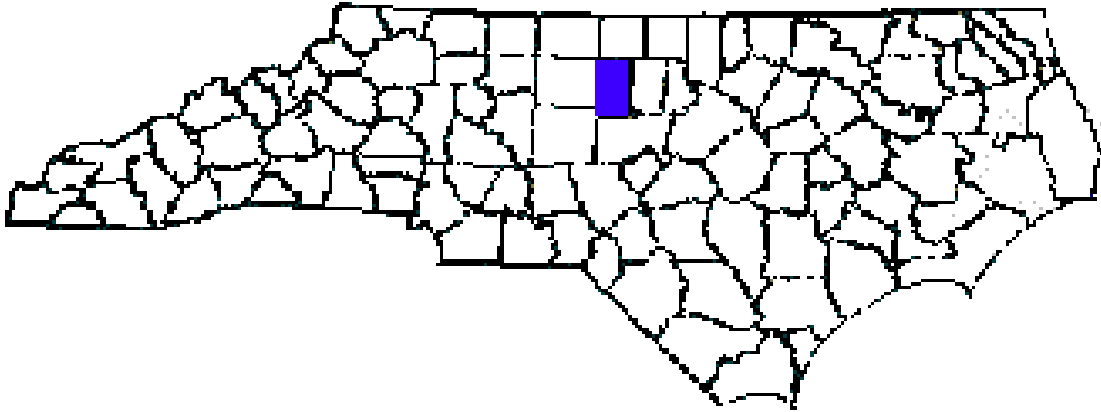


ANNUAL REPORT FOR 2005



Michael's Branch Mitigation Site
Alamance County
TIP No. U-3110A



Prepared By:
Natural Environment Unit & Roadside Environmental Unit
North Carolina Department of Transportation
December 2005

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Summary

The following report summarizes the stream monitoring activities that have occurred during the Year 2005 at the Michael's Branch Mitigation Site in Alamance County. This site was constructed during 2003 by the North Carolina Department of Transportation (NCDOT). This report provides the monitoring results for the first formal year of monitoring (Year 2005). The Year 2005 monitoring period was the first of three scheduled years for monitoring on Michael's Branch (See Success Criteria Section 2.1).

Based on the overall conclusions of monitoring along Michael's Branch, it has met the required monitoring protocols for the first formal year of monitoring. The channel and the structures throughout the stream are stable at this time. The stream bank and buffer area is highly vegetated for the first year of monitoring. The North Carolina Department of Transportation will continue stream monitoring at the Michael's Branch Site for 2007.

1.0 INTRODUCTION

1.1 Project Description

The following report summarizes the stream monitoring activities that have occurred during the Year 2005 at the Michael's Branch Mitigation Site. The site is located just north of Interstate 40 on University Drive in Alamance County (Figure 1). The Michael's Branch Site was constructed to provide mitigation for stream impacts associated with Transportation Improvement Program (TIP) number U-3110A in Alamance County.

The mitigation project covers approximately 780 linear feet of channel length. Construction was completed during 2003 by the North Carolina Department of Transportation (NCDOT). Stream restoration involved the installation of cross vanes, dual fiber logs, sloping the adjacent streambanks to promote stability, and widening the floodplain to allow for major flood events. It also included the installation of coir fiber matting and live stakes along the streambank and bareroot seedlings in the buffer area.

1.2 Purpose

In order for a mitigation site to be considered successful, the site must meet the success criteria. This report details the monitoring in 2005 at the Michael's Branch mitigation site. Hydrologic monitoring was not required for the site.

1.3 Project History

December 2003	Construction Completed.
February 2005	Planted Live Stakes and Bareroot Seedlings
September 2005	Stream Channel Monitoring (1 yr.)

NORTH CAROLINA



ALAMANCE COUNTY



VICINITY MAPS

NCDOT
DIVISION OF HIGHWAYS
ALAMANCE COUNTY
PROJECT: 8.2472001 (U-3110A&B)
COOK ROAD UPGRADE AND
EXTENSION FROM US 70 TO
NORTH OF WEST BROOK AV.

SHEET 1 OF 19 3/1/02

2.0 STREAM ASSESSMENT

2.1 Success Criteria

The following surveys were conducted in support of the monitoring assessment:

Stream Geomorphological Assessment

- ◆ The stream shall be monitored for a duration of 5 years from end of construction (channel modifications and vegetation planted)
- ◆ The data shall be collected and submitted to the NCDWQ and the US Army Corp of Engineers in the 1st, 3rd, and 5th years after construction
- ◆ The stream dimension shall be measured using permanent cross-sections (surveyed or GPS) established at a distance of 1 per every 20 bankfull-widths
- ◆ The measurements for dimension shall include a measurement of the stream width/depth ratio, entrenchment ratio, and low bank height ratio (low bank height/max. bankfull depth)
- ◆ The stream pattern shall be ascertained through measurements of stream sinuosity, meander width ratio, and radius of curvature (on newly constructed meanders only 1st year monitoring)
- ◆ The stream profile shall be ascertained by measurement of stream slope including the average pool and riffle slope as well as the overall stream slope, and the pool to pool spacing
- ◆ Pebble Counts for the stream shall be performed and presented to NCDWQ

Stream Vegetative Assessment

- ◆ Riparian buffers must be planted to achieve such that the survival of 260 stems/acre for trees after five years is attained. Tree densities of less than the prescribed amount will necessitate remedial actions by NCDOT

2.2 Stream Description

2.2.1 Post-Construction Conditions

The mitigation of Michael's Branch involved the construction of rock cross vanes, installation of dual fiber logs, and additional bank sloping. Cross vanes were installed between glides and riffles. Coir fiber matting was installed along the banks throughout the entire reach.

2.2.2 Monitoring Conditions

The objective of the Michael's Branch stream restoration was to build a C6 stream that has the potential to develop into a E5 stream as identified in the Rosgen's Applied River Morphology. A total of two cross sections (one in the riffle and one in the pool) were surveyed. For this report, only cross sections containing riffles were used in the comparison of channel morphology presented

below in Table 1. Data shown in Table 1 includes one cross section chosen to represent a riffle section.

Table 1. Abbreviated Morphological Summary (Michael's Branch Site)

Variable	Proposed	2005	2007	2009
		Cross-Section #1		
Drainage Area (mi ²)	1.5	1.5		
Bankfull Width (ft)	25.0	21.8		
Bankfull Mean Depth (ft)	1.2	1.2		
Width/Depth Ratio	20.8	18.14		
Bankfull Cross Sectional Area (ft ²)	29.7	26.19		
Maximum Bankfull Depth (ft)	0.6	2.22		
Width of Floodprone Area (ft)	>50	37.5		
Entrenchment Ratio	>2.2	1.72		
Slope		.0015		
Particle Sizes (Riffle Sections)				
D ₁₆ (mm)		1.14		
D ₃₅ (mm)		4.85		
D ₅₀ (mm)		8		
D ₈₄ (mm)		15.79		
D ₉₅ (mm)		40.67		

*Drainage Area, Floodprone Width, and Slope are averaged values only.

2.3 Results of the Stream Assessment

2.3.1 Site Data

The assessment included the survey of two cross sections and the longitudinal profile of Michael's Branch established by the NCDOT after construction. The length of the profile along Michael's Branch was approximately 250 linear feet. Two cross sections were established during the 2005 monitoring year. Cross section locations were subsequently based on the stationing of the longitudinal profile and are presented below. The locations of the cross sections and longitudinal profiles are shown in Appendix A.

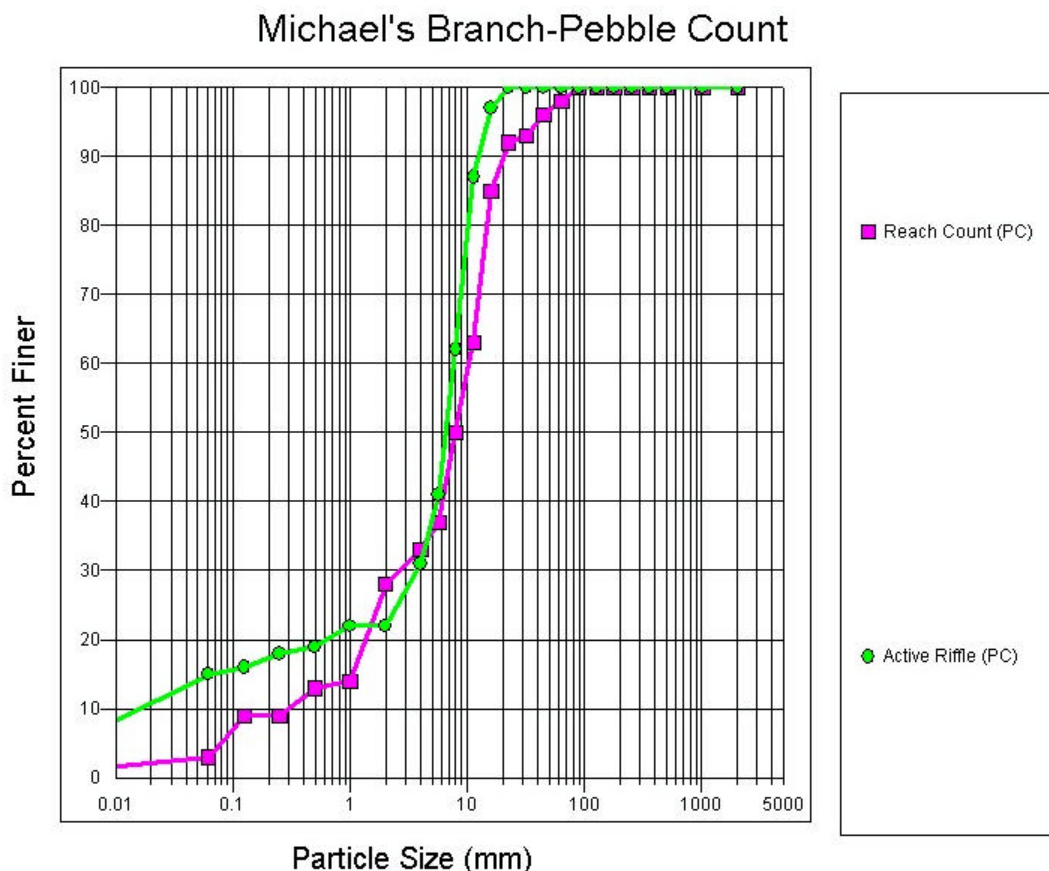
- ◆ Cross-Section #1. Michael's Branch, Station 180.4 linear feet, midpoint of riffle
- ◆ Cross-Section #2. Michael's Branch, Station 225.5 linear feet, midpoint of pool

Based on comparisons of design cross section data and Year 2005 monitoring data, both cross sections appear stable with little or no active bank erosion.

Graphs of the cross sections are presented in Appendix A. Future survey data will vary depending on actual location of rod placement and alignment, however, this information should remain similar in appearance.

Pebble counts were also taken at each cross section as a means to determine the bed material at each cross section location. However, only pebble counts taken at riffle sections will be utilized to classify the stream. No existing data was available for Michael's Branch. The pebble counts taken during the Year 2005 monitoring period noted that the D_{50} (50 percent of the sampled population is equal to or finer than the representative particle diameter) for the riffle sections of Michael's Branch was approximately 6.69mm, which is indicative of a gravel-bed stream.

A chart depicting the particle size distributions for Michael's Branch for the Year 2005 is presented below.



2.4 Results of Stream and Buffer Vegetation

2.4.1 Description of Species

The following tree species were planted on the stream bank:

Salix nigra, Black Willow

Cornus amomum, Silky Dogwood

The following tree species were planted in the buffer area:

Betula nigra, River Birch

Platanus occidentalis, Sycamore

Nyssa sylvatica var. *sylvatica*, Blackgum

Liriodendron tulipifera, Tulip Poplar

Fraxinus pennsylvanica, Green Ash

2.4.2 Results of Vegetation Monitoring

Streambank Vegetation: The stream is highly vegetated throughout the channel with black willow, silky dogwood, and tag alder. Other wetland grasses noted along the channel are *Juncus* sp., woolgrass, and various grasses.

Buffer Vegetation: One vegetation plot was set to determine the trees per acre in the buffer area. There were no at planting counts conducted so therefore it is assumed that 39 total trees were planted in the 50 ft. x 50 ft. plot.

Plot #	River Birch	Sycamore	Blackgum	Tulip Poplar	Green Ash	Total (1 year)	Total (at planting)	Density (Trees/Acre)
1		5	1	3	1 4	2 3	3 9	4 0 1
Average Density (Trees/Acre)								4 0 1

Site Notes: Other vegetation noted: lespedeza, aster, goldenrod, fennel, foxtail, multi-flora rose, briars, clover, and various grasses. River Birch was noted outside of the plot location.

2.4.3 Conclusions

There was only 1 vegetation monitoring plot established throughout the 1.97 acre planting area. The 2005 vegetation monitoring of the site revealed an average tree density of 401 trees per acre. This average is above the minimum success criteria of 320 trees per acre for year one monitoring.

3.0 OVERALL CONCLUSIONS

The Michael's Branch Site has met the required monitoring protocols for the first formal year of monitoring. The channel and structures throughout the stream are stable at this time. The stream bank and buffer area is highly vegetated for the first year of monitoring. NCDOT will continue monitoring in 2007.

4.0 REFERENCES

North Carolina Department of Transportation (NCDOT), October 22, 2002.
Permit for Cook Road Connector (U-3110A).

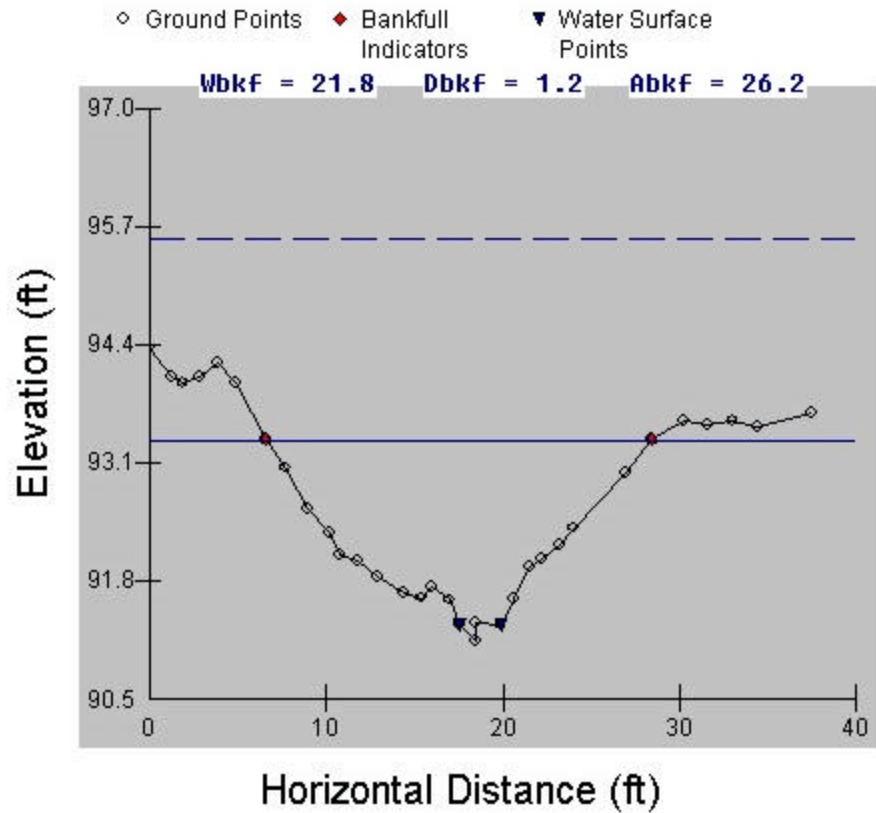
Rosgen, D.L, 1996. Applied River Morphology. Wildland Hydrology, Pagosa Springs, Colorado.

US Army Corps of Engineers (USACE), 2003. Stream Mitigation Guidelines.
Prepared with cooperation from the US Environmental Protection Agency,
NC Wildlife Resources Commission, and the NC Division of Water Quality.

APPENDIX A

CROSS SECTIONS AND THE LONGITUDINAL PROFILE COMPARISON

Riffle Cross Section #1

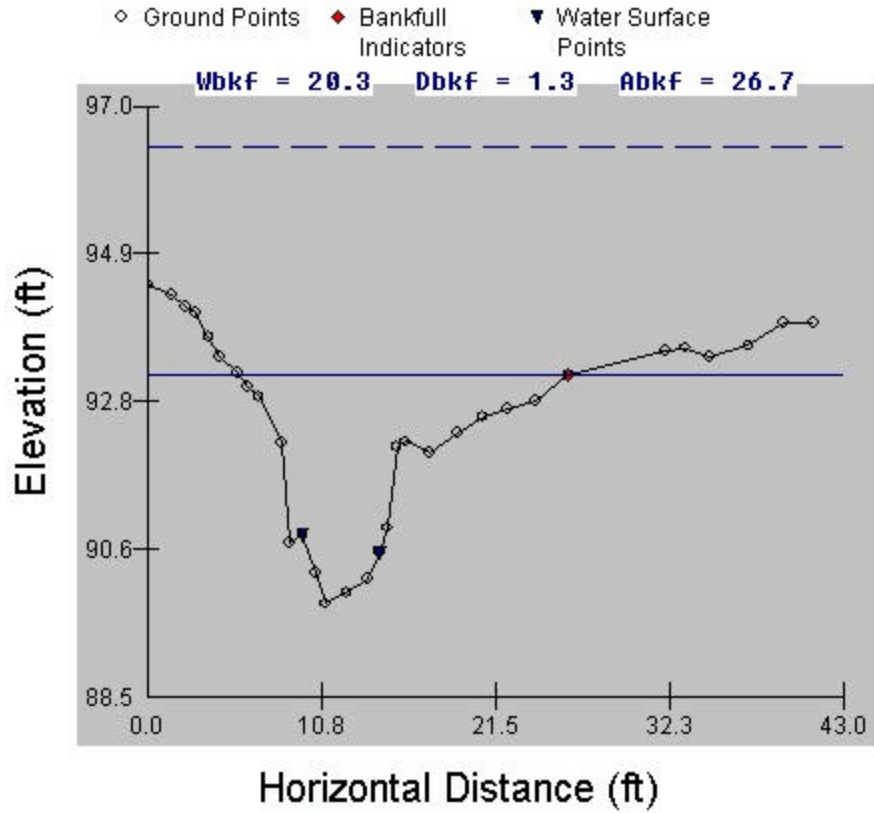


Cross-Section #1 (Riffle) Abbreviated Morphological Summary

	2005	2007	2009
Bankfull Cross Sectional Area (ft ²)	29.7		
Maximum Bankfull Depth (ft)	2.22		
Width of the Floodprone Area (ft)	37.5		
Bankfull Mean Depth (ft)	1.2		
Width/Depth Ratio	18.14		
Entrenchment Ratio	1.72		
Bankfull Width (ft)	21.8		



Pool Cross Section #2



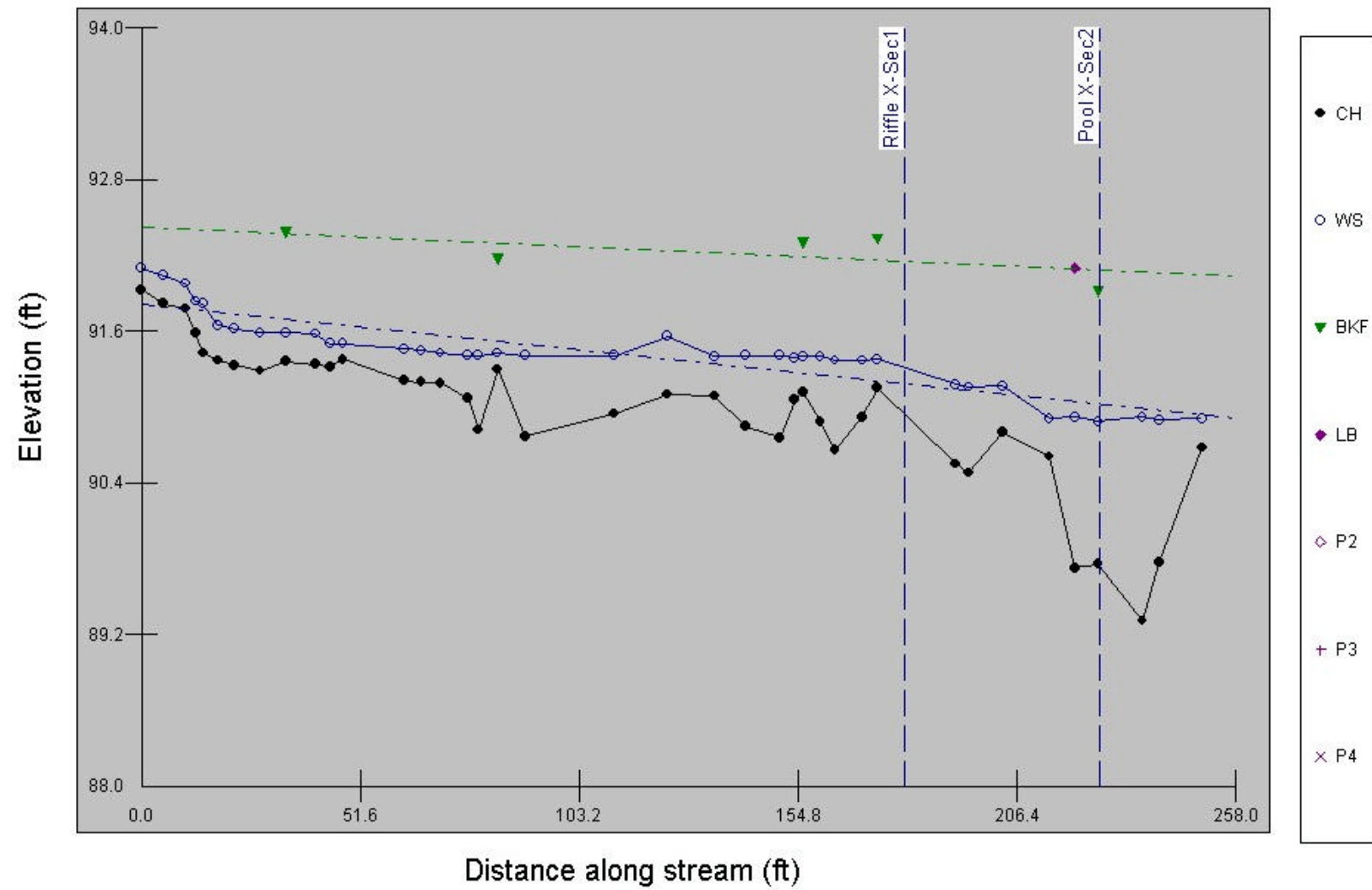
Cross-Section #2 (Pool) Abbreviated Morphological Summary*

	2005	2007	2009
Bankfull Cross Sectional Area (ft²)	26.69		
Maximum Bankfull Depth (ft)	3.28		
Bankfull Mean Depth (ft)	1.32		
Bankfull Width (ft)	20.28		

* According to the Rosgen Classification of Natural Rivers floodprone width, entrenchment ratio, and width depth ratio are not measured in pool, glide, or run features.



Michael's Branch



APPENDIX B
SITE PHOTOGRAPHS

Michael's Branch



PP #1 (Upstream-East of University Drive)



PP #2 (Downstream-West of University)



PP #3 (Upstream-Cross Section #1)



PP #3 (Downstream-Cross Section #1)



PP #4 (Upstream-Cross Section #2)



PP #4 (Downstream-Cross Section #2)

September 2005

Michael's Branch



PP # 5 (Upstream-North of Sub-division Bridge)



PP #5 (Downstream-North of Sub-division Bridge)



PP #6 (Upstream-South of Sub-division Bridge)



PP #6 (Downstream-South of Sub-division Bridge)



PP#7 (Overview of Site Looking Downstream Towards the Sub-division Bridge)

Michael's Branch



PP#7 (Overview of Site Looking Across Site at University Drive)



PP #7 (Overview of Site Looking Upstream Towards University Drive)

September 2005

MICHAEL'S BRANCH MITIGATION SITE

